PCT WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 6 : B60C 11/16 — A1

(11) International Publication Number: **WO 97/26144**

(43) International Publication Date: 24 July 1997 (24.07.97)

(21) International Application Number: PCT/NO97/00001

(22) International Filing Date: 2 January 1997 (02.01.97)

(23) Statement concerning non-prejudicial disclosure or exception to lack of novelty:
Date of the disclosure : 1995 or 1996
Kind of the disclosure: Unauthorized written disclosure (filing of patent applications).

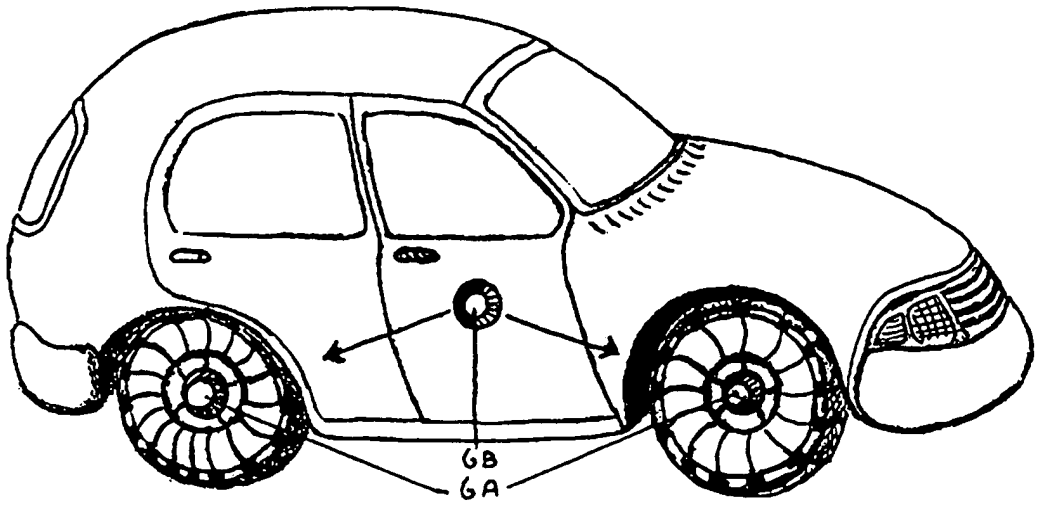
(30) Priority Data:
955043 2 January 1996 (02.01.96) NO

(71)(72) Applicant and Inventor: HANSEN, Iver [NO/NO]; Gjerdalsveien 3, N-3442 Hyggen (NO).

(81) Designated States: AT, CA, CH, CN, CZ, DE, DK, EE, FI, GB, HU, IS, JP, LT, LU, LV, MK, NO, PL, RO, RU, SE, SI, SK, US, Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).

Published
With international search report.

(54) Title: ADJUSTABLE VEHICLE TIRE STUD SYSTEM



(57) Abstract

Adjustable vehicle tire stud system, optionally operated by solar cells and wireless remote control, allowing a quick traction adjustment from the driver's seat when required for better road grip on slippery and icy roads.

FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AM	Armenia	GB	United Kingdom	MW	Malawi
AT	Austria	GE	Georgia	MX	Mexico
AU	Australia	GN	Guinea	NE	Niger
BB	Barbados	GR	Greece	NL	Netherlands
BE	Belgium	HU	Hungary	NO	Norway
BF	Burkina Faso	IE	Ireland	NZ	New Zealand
BG	Bulgaria	IT	Italy	PL	Poland
BJ	Benin	JP	Japan	PT	Portugal
BR	Brazil	KE	Kenya	RO	Romania
BY	Belarus	KG	Kyrgystan	RU	Russian Federation
CA	Canada	KP	Democratic People's Republic of Korea	SD	Sudan
CF	Central African Republic			SE	Sweden
CG	Congo	KR	Republic of Korea	SG	Singapore
CH	Switzerland	KZ	Kazakhstan	SI	Slovenia
CI	Côte d'Ivoire	LI	Liechtenstein	SK	Slovakia
CM	Cameroon	LK	Sri Lanka	SN	Senegal
CN	China	LR	Liberia	SZ	Swaziland
CS	Czechoslovakia	LT	Lithuania	TD	Chad
CZ	Czech Republic	LU	Luxembourg	TG	Togo
DE	Germany	LV	Latvia	TJ	Tajikistan
DK	Denmark	MC	Monaco	TT	Trinidad and Tobago
EE	Estonia	MD	Republic of Moldova	UA	Ukraine
ES	Spain	MG	Madagascar	UG	Uganda
FI	Finland	ML	Mali	US	United States of America
FR	France	MN	Mongolia	UZ	Uzbekistan
GA	Gabon	MR	Mauritania	VN	Viet Nam

ADJUSTABLE VEHICLE TIRE STUD SYSTEM

The present invention relates to a movable tire stud system, optionally operated by solar cells and wireless remote control, allowing a quick traction adjustment from the driver's seat when required for better road grip on slippery and icy roads.

A wide variety of systems for improving traction on icy and slippery roads have been constructed. However, most systems do not function satisfactorily in the long run. They are often worn out too quickly due to the considerable wear and tear such systems must endure during the course of driving. Many systems, like Icelandic laid-open publication #131970 require air pressure to move studs in and out. Like in shock absorbers, the air will compress and consequently such studs are easily forced back into the tires without improving traction satisfactorily.

Other systems, like U.S.Patent # 2941566, requires studs to penetrate the tire casing. According to professionals, penetration of the tire casing will in the long run lead to air leakages and humidity in the tire causing steel belt corrosion and tire separation.

Norwegian patent application #922913 and WO Al 9416913 do not have the disadvantages mentioned above regarding use of air pressure and tire casing penetration because that system is based on incompressible hydraulic fluid and mounted into the tires on the outside of the tire casing. However, such a movable stud system should preferably be used on larger tires or on tires especially molded and thereby having sufficient rubber thickness for such a system.

Experiments has led to the stud system hereby presented as it has several advantages. First, it may be mounted on small vehicle tires presently on the market without considerable changes in the production of such tires. Secondly, the stud system mentioned herein is more accessible and easy to repair and maintain than most systems molded into the tires.

CONFIRMATION COPY

Many attempts have been made to adjust components on a spinning wheel from the driver's seat. Publications show various connections between the wheels and an hydraulic pump positioned in the vehicle body. Such arrangements necessitate the use of rotating unions that sooner or later will leak due to the considerable wear and tear on such components.

The present invention solves this problem by a new combination of solar cells (50,55) and wireless remote control(6A,6B,6D) and an hydraulic pump (1) for air-free, incompressible fluid positioned in the wheel rim center. Considering that the movable studs are only used occasionally and that the hydraulic pump is frequently exposed to sunrays or daylight, solar cells seems very suitable for such a system. Besides, such facilities makes it easier for the drivers to consentrate on the traffic and thereby increase traffic safety.
To avoid traffic jam due to icy and slippery roads, traction adjustment from the driver's seat may be a good solution.

At last, but not at least, the present invention offers a considerably shorter braking distance on icy, slippery roads than by the use of ordinary studs. This is possible by designing the studs with a narrowed portion close to the stud tip. That makes the stud tip edge sharper so that the stud grips the ice like a claw. A tilting cylinder-shaped ordinary tire stud will slide much more easily due to it's shape.
In other words, not only will the present invention help drivers to get more easily from one place to another on icy, slippery roads, it may also offer better traffic safety, less accidents and saved lives.

Consequently, there is an obvious need for the movable stud system as presented herein. The need is met by making available a stud system of the type precisely defined in the appended patent claims.

The stud system in accordance with the present invention is hereby described more closely by referring to exemplary embodiments thereof and with reference to the enclosed drawings wherein:

Figure 15 shows the main part of the adjustable stud system including one transmitter (6B) located at the exterior of the vehicle body. The transmitter is connected to a control panel in the driver's compartment. For example, by pressing switches connected to the transmitter, the driver thereby sends signals by wireless remote control to the receiving remote control(6A) located in the wheel rim, making the hydraulic pump (1) move the studs (90) in or out, to a retracted or protruded position in the stud hole or sleeve/housing (18).
The hydraulic pump (1), including electromotor (4), rechargeable battery (5), remote control for signal reception (6A), piston (12), piston guides (11), hydraulic pressure chamber(3) and solar power cell(s) (50,55) is for example located centrally in the wheel rim in a cylindrically shaped box, preferably made of metal, together constituting an hydraulic pump (1). To avoid rotation of the piston (12) when the electromoter (4) is running, the piston guide pins (11) are protruding into the piston (12) to keep it in a stable position and counteract rotation. Consequently, the shaft(75) connected coaxially to the electromotor (4), will screw the piston back or forth, depending on which way the electomotor is rotating. Wires connect the solar cells to battery and motor.
Figure 100 shows a cross section of the wheel, including the hydraulic pump (1) and compenents as mentioned above.
The piston (12) has a sealing (12A) to avoid leakage and maintaining hydraulic pressure necessary to move studs(90) out or to achieve vacuum and stud retraction when the piston is screwed back towards the electromotor(4). Hydraulic conduits between the hydraulic pump (1) and the studs (90) may for instance be shaped like tubes(9), preferably reinforced by a flexible steel sleeve (9) and a wire (70). The wire (70) shown on figure 14 C will counteract the centrifugal force when the wheel is rotating, thereby keeping the studs and stud housing means(90,18) in a stable position. Elastic means (40,45) which may for example be springs or thick rubber tubes, will function as shock absorbers or protection for the hydraulic conduits (9).

Figure 14 shows the wheel seen from the outside.
The tube (24) positioned like a circle in the wheel rim, functions like a distributor of hydraulic fluid from the pump (1) to the hydraulic tubes (9) and stud housing means(30). A wire (17) attached to the stud housing means (30) by the tire shoulder, may be tightened by a nut (35), thereby pulling the stud housing means closer to the tire. A lid (50B) may be tightened by screws(95), thereby both fastening the wire (17) to the stud housing means (30) and also fastening the hydraulic tube (9) better to the stud housing means.

Figure 11H, and figure 10Y 25 shows stud housing means (18) having protruding edges (23) adapted to fit the adjacent tire shoulder pattern to better secure the studs in their position when friction, braking or acceleration tend to tilt the studs. A nut (80) mounted on the stud housing means (18) is designed to be gripped by a tool, so that studs are easily replaced when needed.
Figure 100 also shows an air storage compartment (96) for air pressure reserves transferable to the tire, optionally available.
Instead of the electromotor (4) there may be mounted a handle by which it is possible to screw the piston (12) back and forth,thereby also moving studs (90). If so, there is no need for the solar cell (50,55), remote control (6a,6B, battery(5) when the pump is only operated manually.
Figure 6R and figure 7D shows a cross section of the tire where also a wire(16) positioning the movable stud system to the tire is shown. At each end of the wire (16) the wire has an enlargement (19)like a nut or wire-head, by which the stud housing means (18) may be pressed towards the tire by tightening the nut at the end of the wire.
Fig.200 shows a cross section of a tire having a protecting shield (26B) on the outside of the hydraulic conduits(9). Inside the shield (26B) there may be a passage through which may be treaded a thin hydraulic tube (9) to be fastened to a tube (24) mounted in a circle paralell or close to the rim edge. Said thin tube may be attached to other tube (24)

which serves as a distributor of hydraulic fluid to the studs or channels the fluid back to the pressure chamber in the rim when the studs move back to retracted position.
Fig.100 shows a cross section also of a protecting shield (26A) which is shaped almost like loose white side walls to be mounted on tires for ornamental reasons. However, in figure 100 and 20 the shield serves both as means for positioning the hydraulic tubes correctly on the tire side walls, being attached to the tubes (9) by clips, screws (46) etc. as well as protecting the hydraulic tubes (9) from shocks when driving.
The wire (16) mounted in or at the tire tread may be stiff or easy to bend or twist by consisting of several small wires attached together. The wire may also have a shape that is more flat and wide, like a band (16B) of a strong, durable material, for example metal, to be mounted on the tire tread.

Figure 10 show a stud (90) having a narrow section close to the stud tip. Seen from the side, the stud tip's flat end has in relation to the stud tip's side an angle of less than 80degrees, enabling the stud to grip the ice like a claw, especially when being tilted slighyly. The outer diameter at the end of the stud tip is larger than the diameter of the narrowed part.
Figure 100 also show a solar cell (50) having a larger diameter, designed to energize heating wires close to movable studs and piston (12).

C L A I M S

1) System of vehicle tire studs movable ~~or~~ (air-free) incompressible hydraulic fluid,
characterized in that the movable stud system has means (16B, 16, 17, 19, 9, 40, 45, 26A, 26B, 26C, 46, 24) for positioning ~~said~~ system on the outer surface of the tires.

2) Stud system as claimed in claim 1, wherein said positioning means comprise wires (16) to be mounted into the tire tread pattern on the outside of the tire casing and adjustable attachment devices on the outside of the wheel/tire sides (17,19).

3) System as claimed in claim 1, wherein said positioning means comprise bands (16B) of strong, durable material, for example metal (on the outside), to be mounted on the tire tread on the outside of the tire casing.

4) System as claimed in claim 2 or 3, wherein hydraulic conduits (9) have the double function of supplying incompressible hydraulic fluid from a hydraulic pump to the movable studs as well as stabilizing the position of said studs outside the tire shoulders.

5) System as claimed in claim 4, wherein said system has a protecting shield (26A, 26B, 26C) ~~(26)~~ on the outside of the hydraulic conduits (9).

6) System as claimed in claim 4,
wherein each stud has a narrowed portion close to the flat, straight end of the stud tip, designed to improve the road grip of the studs even when tilted slightly due to friction, acceleration, breaking etc..
the outer diameter at the very end of said stud tip being significantly larger than the diameter of said narrowed portion.

7) System as claimed in claim 4,
wherein elastic means (40,45) at the wheel rim provide some flexibility to the incompressible hydraulic fluid conduits, thereby absorbing shocks and protecting said conduits from leakages and from being easily torn loose.

8) System as claimed in claim 2 or 3,
wherein each respective one of a plurality of stud housing means (fig.100,18) has an exterior shape adapted to fit the adjacent tire shoulder by having a sloping wall facing the tire shoulder allowing the studs to be positioned at approximately 90 degrees angle in relation to the road pavement when touching it.

9) System as claimed in claim 4,
whereby said system has one or several solar cells charging one or several rechargeable batteries, said solar cells and batteries both being positioned in the wheel rim.

10) System as claimed in claim 9,
wherein said system has defrosting means for removing ice from the hydraulic pump and the stud housing means, for example by means of heating wires energized from said batteries.

11) System as claimed in claim 4,
wherein the system has centrally positioned in the wheel rim a unit comprising solar power cell(s), one or several rechargeable batteries, remote control devices and said hydraulic pump.

12) System as claimed in claim 4,
wherein said hydraulic pump is adapted to be operated manually by a handle, said pump being positioned in the center of the wheel rim.

13) System as claimed in any of the preceeding claims, wherein each ~~tire~~ wheel rim has a storage compartment for air pressure reserves transferable to the tire, when needed for improving road grip on various ice and snow conditions by tire pressure adjustments.

14) System as claimed in claim 11,
wherein said remote control devices are adapted to respond to radio frequency transmissions from at least one transmitter (fig 15, 6B) located at the exterior of the vehicle body, said at least one transmitter being connected to a control panel in the driver's compartment.

15) System as claimed in claim 8,
wherein said stud housing means (18) has exterior protusions (23) adapted to fit the adjacent tire shoulder pattern thus better securing the studs in their position when friction, breaking or acceleration tend to tilt the studs.

16) system as claimed in claim 8,
wherein said stud housing means contains a nut (80), said nut designed to be gripped by a to l, thereby allowing easy replacement of studs when needed.

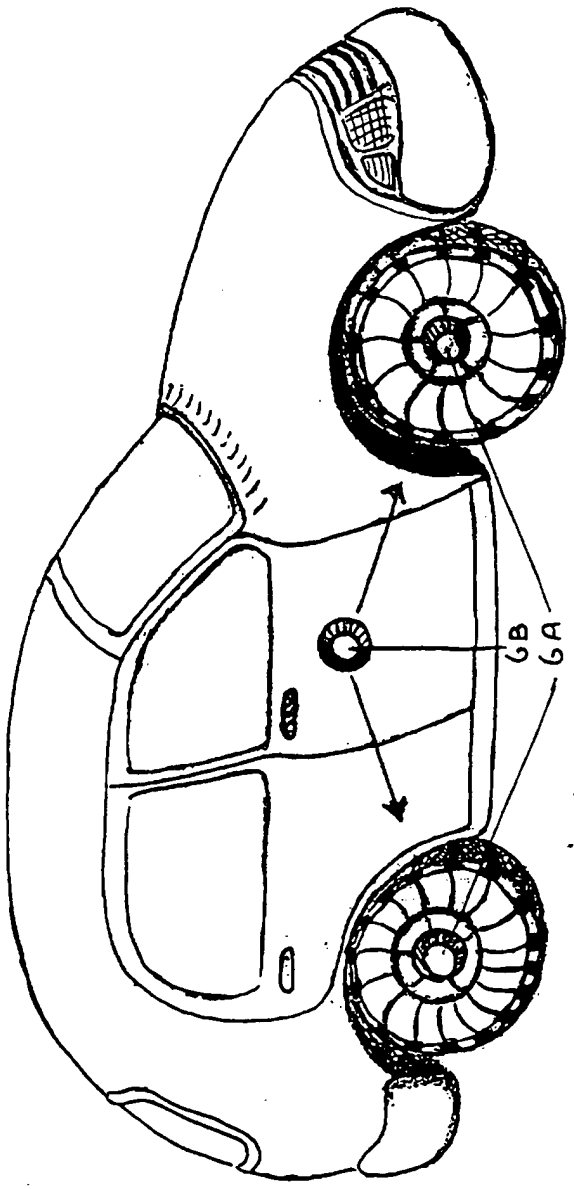


FIG. 15

"DRIVER'S SNOWSHOES" - BILTRUGER V/IVER HANSEN:

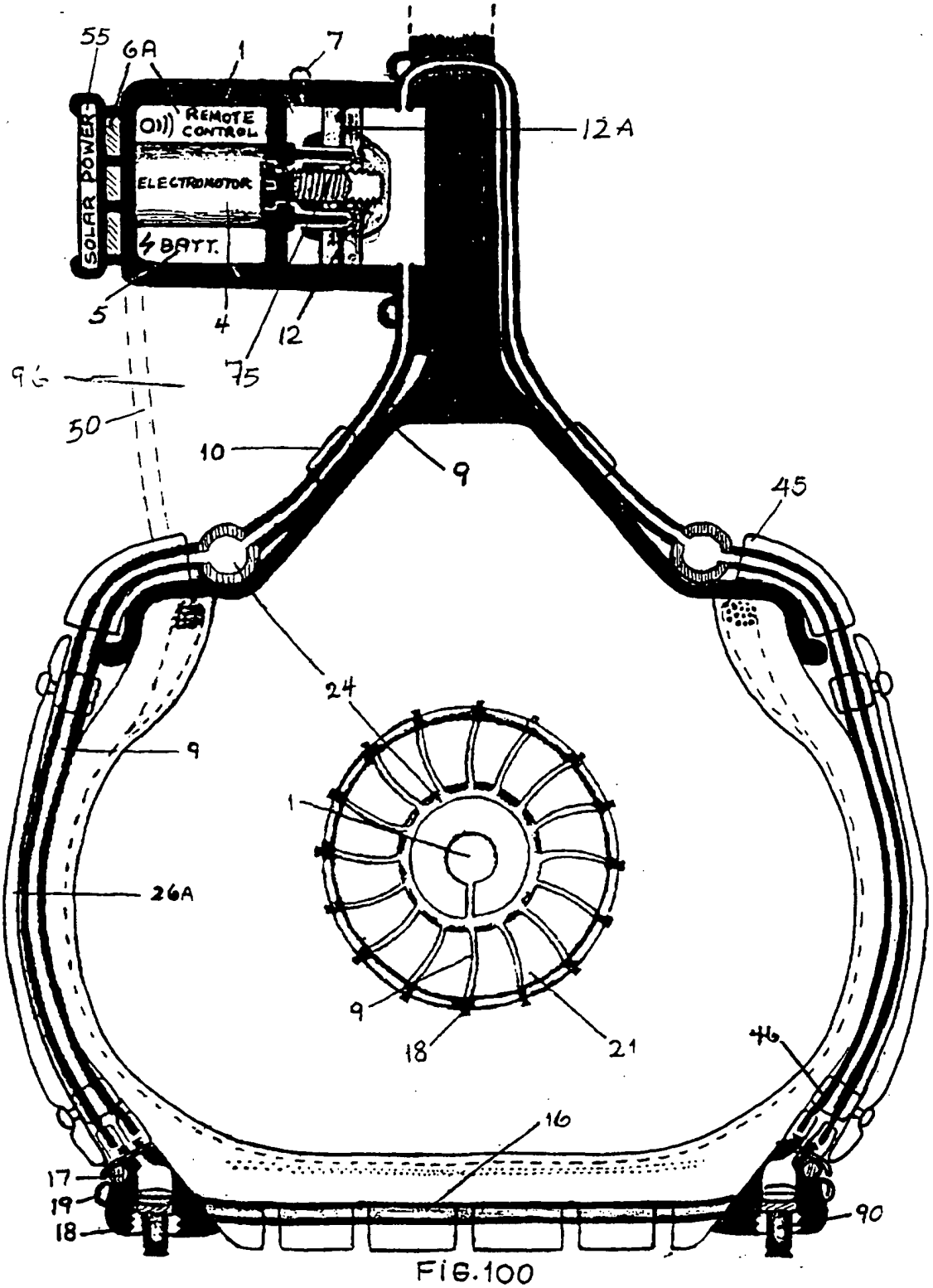


FIG.100

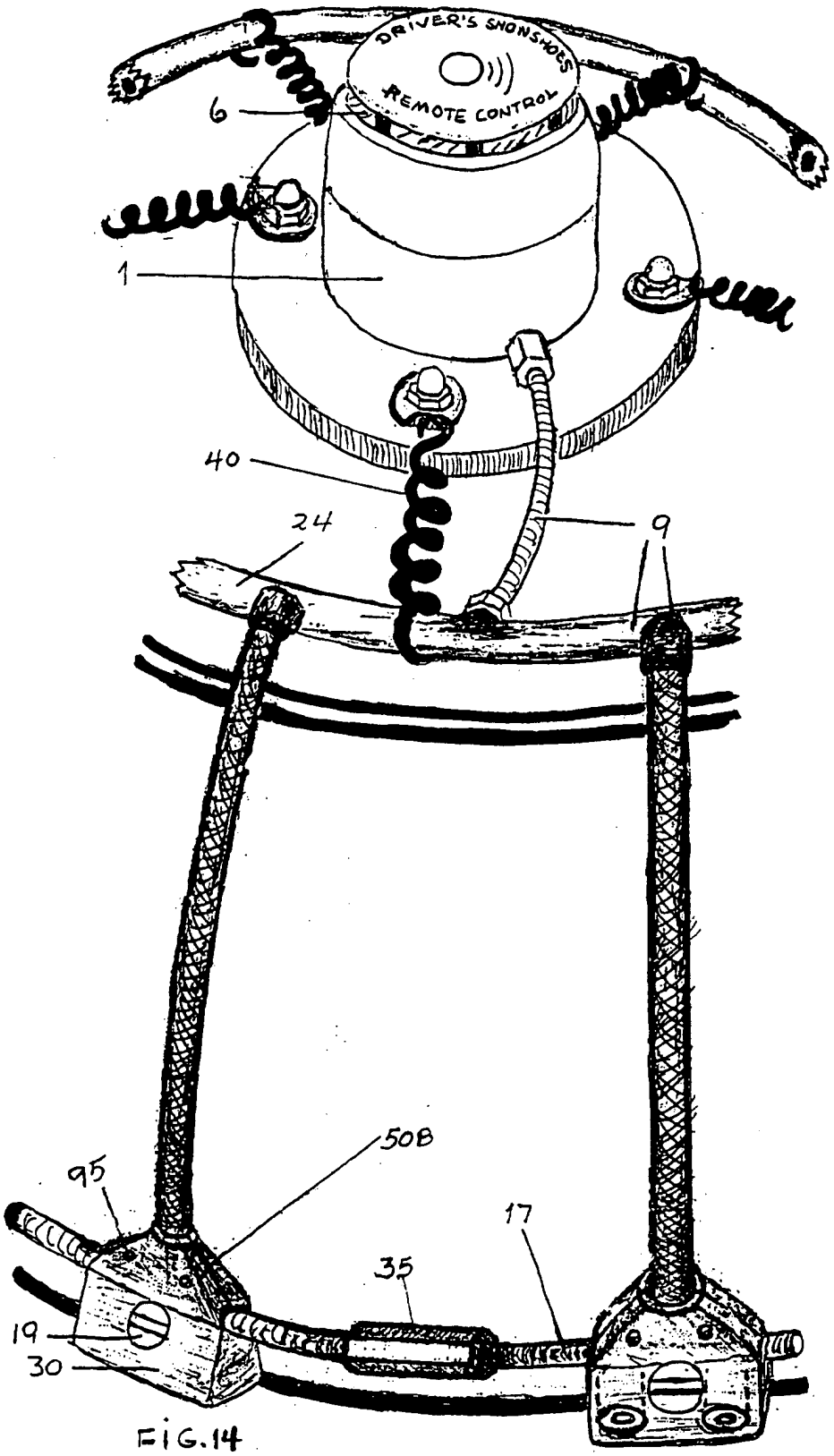


FIG.14

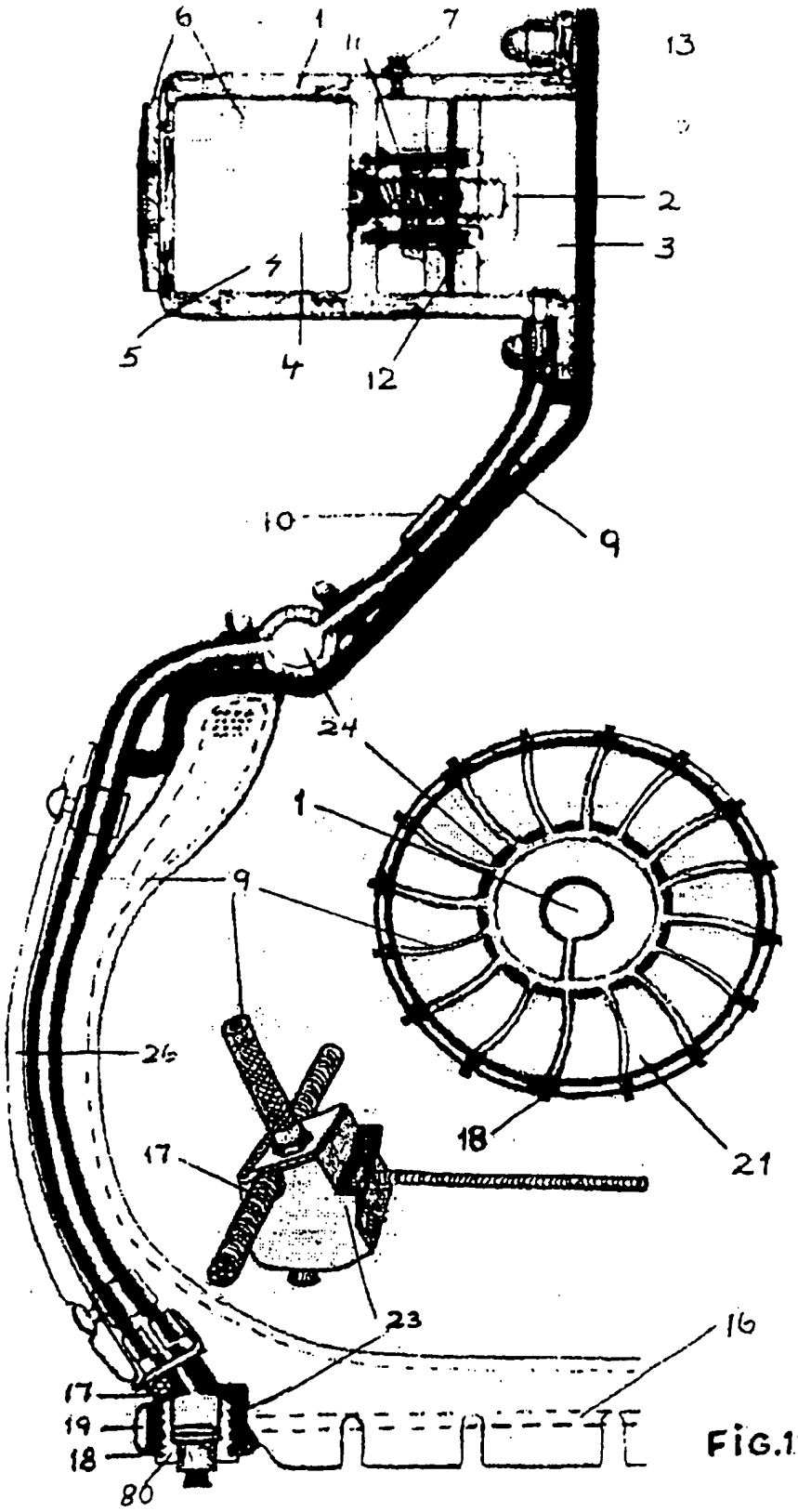


FIG.11H

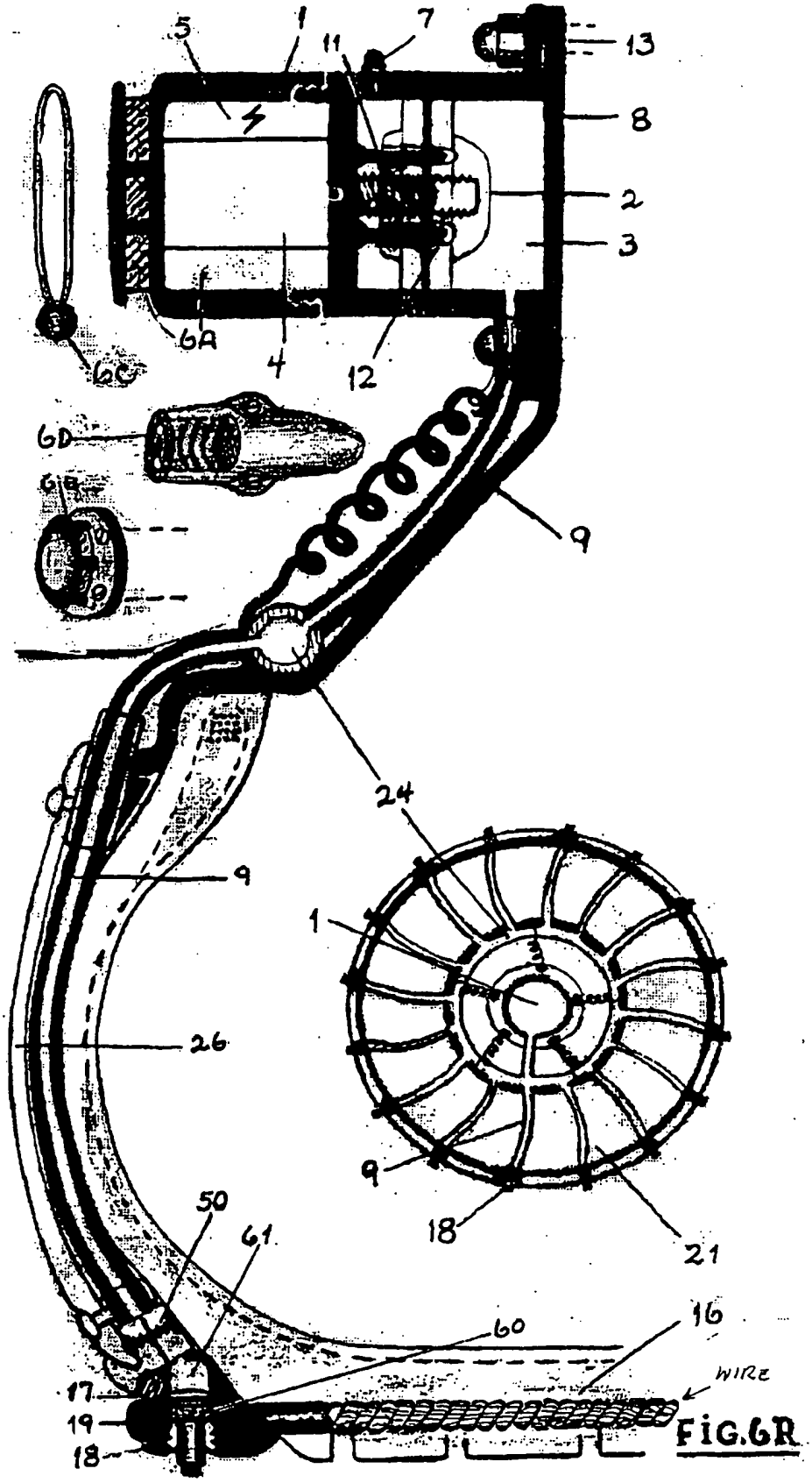

5
1
11
7
13
8
2
3
6A
4
12
6C
6D
6B
9
24
9
1
26
9
18
21
50
61
60
16
WIRE
17
19
18

FIG.6R

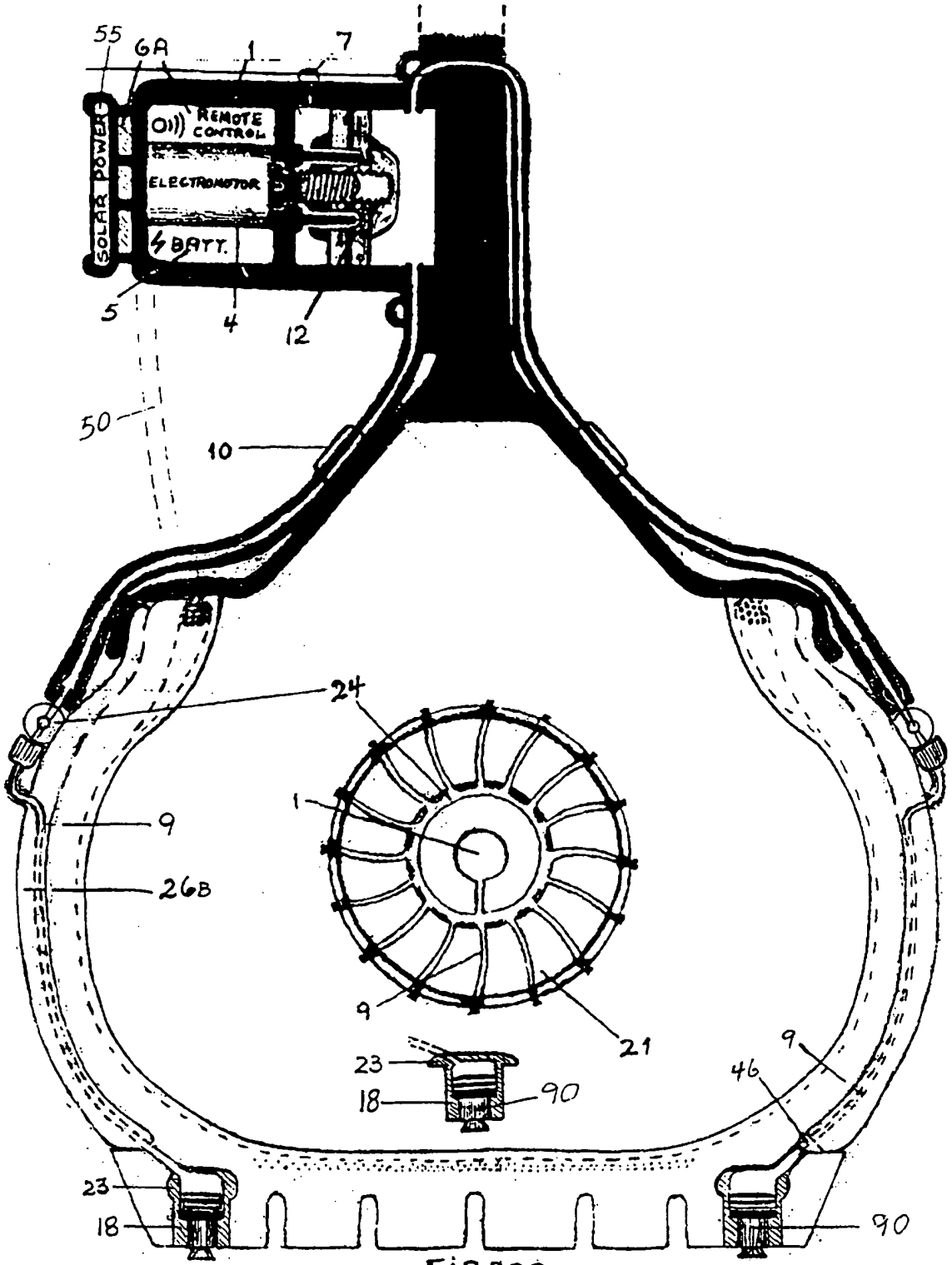

55
6A
1
7
REMOTE CONTROL
ELECTROMOTOR
BATT.
SOLAR POWER
5
4
12
50
10
24
1
9
26B
9
21
23
18
90
9
46
23
18
90

FIG200

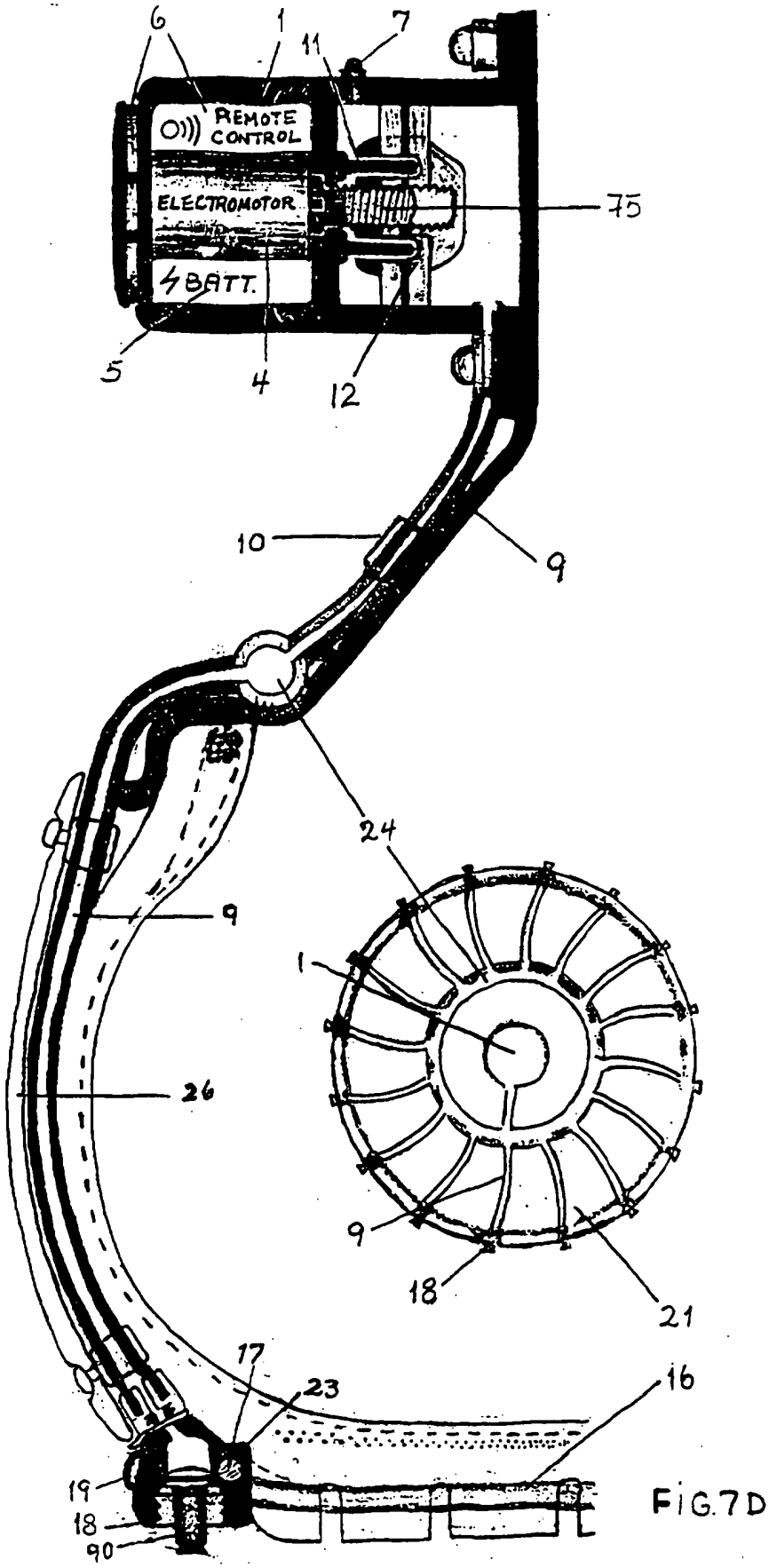

6
1
11
7
REMOTE CONTROL
ELECTROMOTOR
BATT.
75
5
4
12
10
9
24
9
1
26
9
18
21
17
23
16
19
18
90

FIG.7D

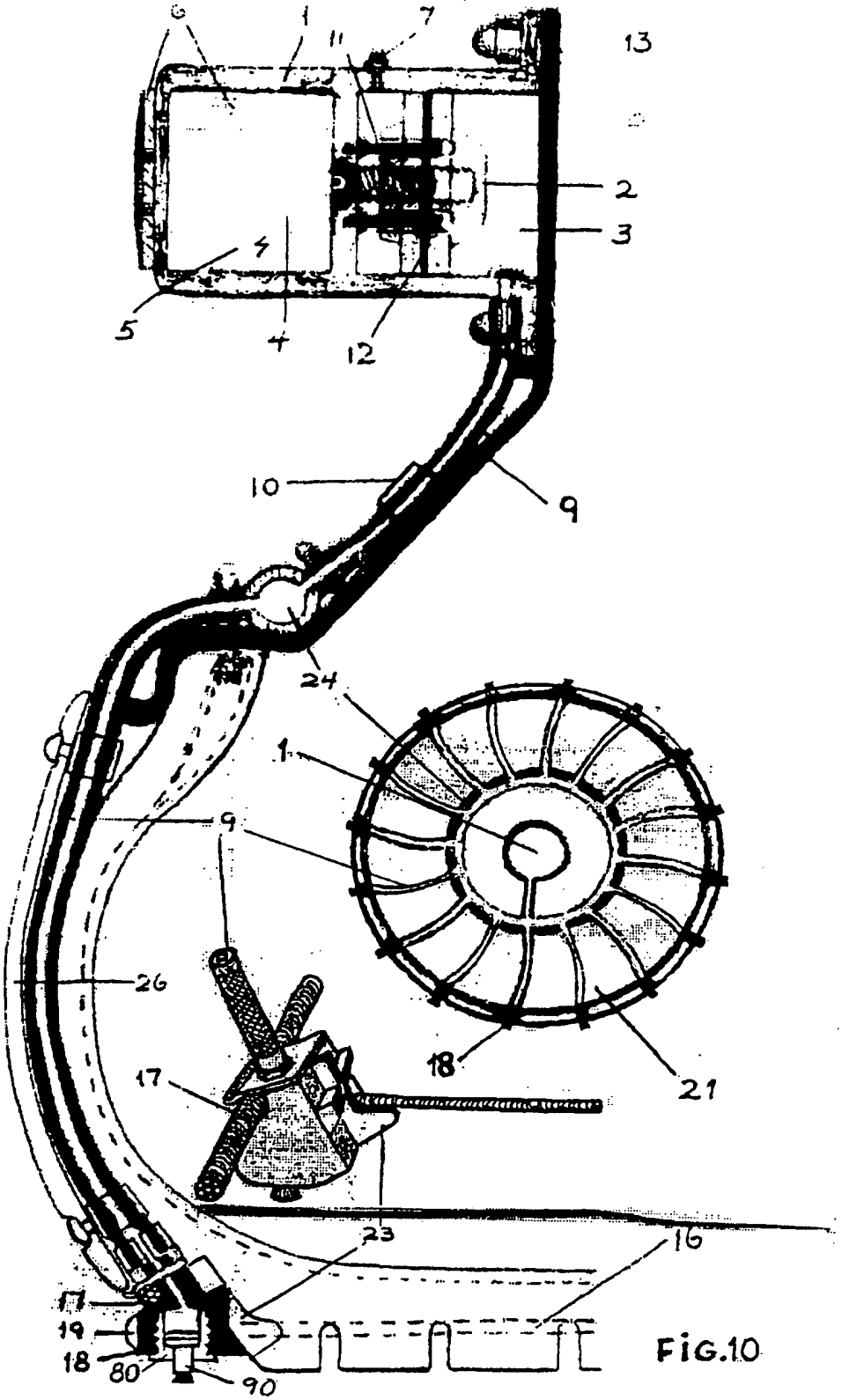


Fig.10

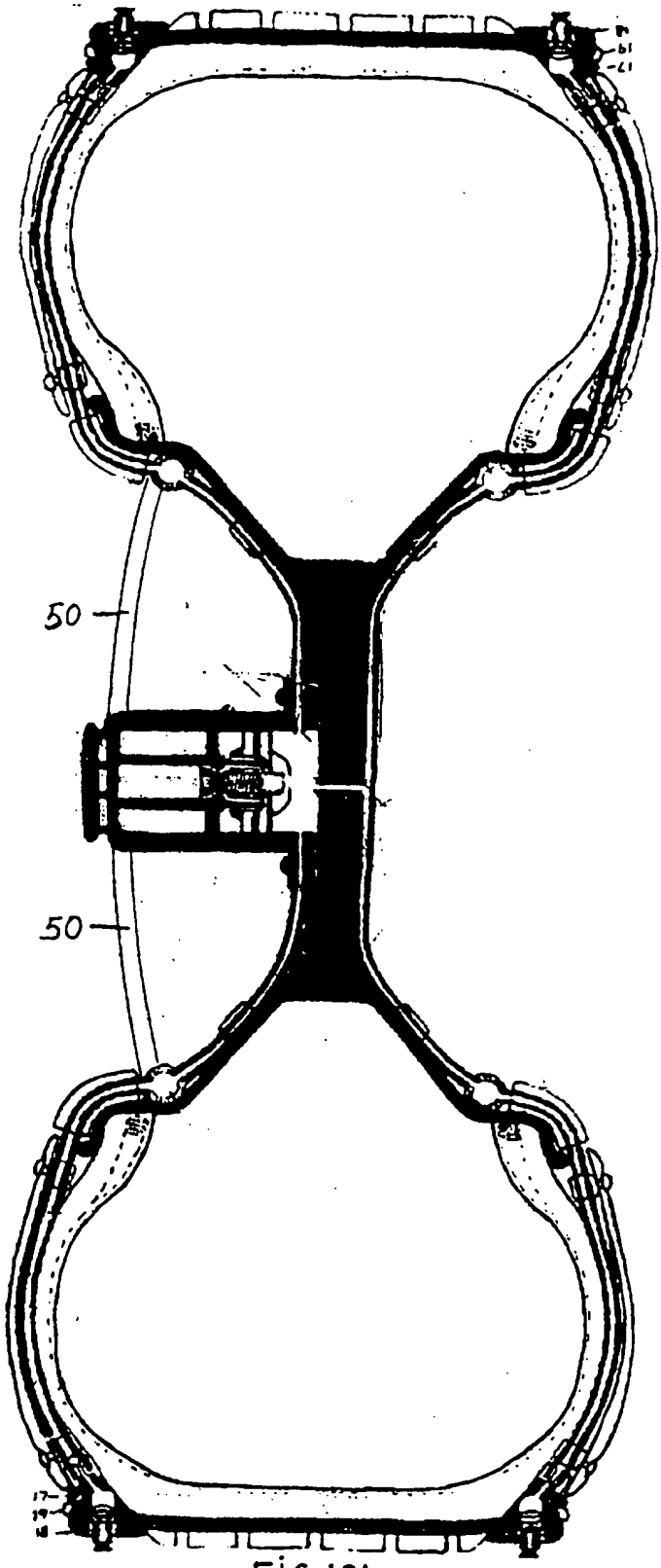


FIG.101

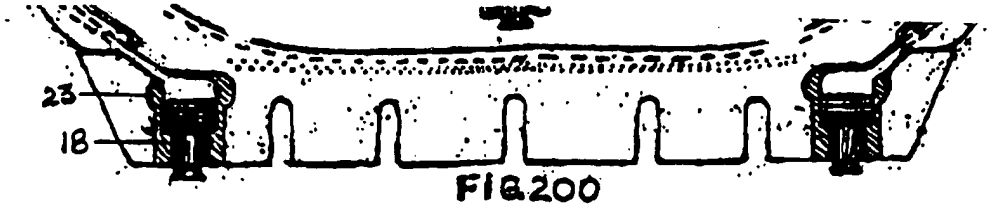
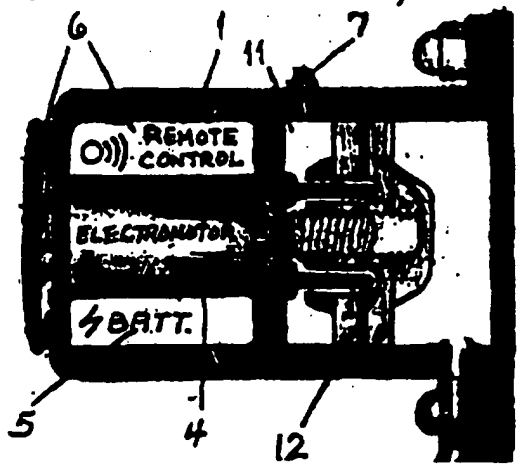


FIG.200

TILLEGG TIL PATENTSØK NR 955043, IVER HANSEN:



FACSIMILE AS RECEIVED BY OBVIOUS ERROR IN TRANSMISSION BY THE NORWEGIAN PATENT OFFICE/ PATENTSTYRET, OSLO, NORWAY. THE REMAINDER OF THE DRAWING WOULD BE OBVIOUS FROM CLAIM # 3, CLAIM #5, CLAIM # 6, CLAIM # 7 and the general description as filed on January 2, 1997.

ACCORDING TO WIPO AND PATENT LAWYERS, the rest of the drawing, fig.200(B), should consequently be acceptable according t PCT ART. 3(2), ART.34(2)(b), ART.19, ART.28 and according to other PCT legislati n.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/NO 97/00001

A. CLASSIFICATION OF SUBJECT MATTER

IPC6: B60C 11/16
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC6: B60C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 9416913 A1 (HANSEN, IVER), 4 August 1994 (04.08.94)	1
	--	
A	US 3400744 A (A.G. MULLER), 10 Sept 1968 (10.09.68)	1
	--	
A	US 4119132 A (RIES), 10 October 1978 (10.10.78)	1
	--	
A	US 5088534 A (ENGEL), 18 February 1992 (18.02.92)	1
	--	

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" erlier document but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
4 February 1997	14 -04- 1997
Name and mailing address of the ISA/ Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. +46 8 666 02 86	Authorized officer Göran Carlström Telephone No. +46 8 782 25 00

INTERNATIONAL SEARCH REPORT

Information on patent family members

04/03/97

International application No.
PCT/NO 97/00001

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 9416913 A1	04/08/94	EP 0680415 A	08/11/95
		FI 953536 A	21/07/95
		JP 8508218 T	03/09/96
		NO 922913 A	22/07/94
		PL 311078 A	05/02/96
US 3400744 A	10/09/68	NONE	
US 4119132 A	10/10/78	AT 354277 A,B	27/12/79
		BE 852374 A	01/07/77
		CA 1050405 A	13/03/79
		CH 626016 A	30/10/81
		DE 2610346 A	15/09/77
		DE 2707114 A	24/08/78
		FR 2343618 A,B	07/10/77
		GB 1577348 A	22/10/80
		JP 52111106 A	17/09/77
		SE 7702559 A	13/09/77
US 5088534 A	18/02/92	DE 3931279 A	28/03/91
		EP 0418703 A	27/03/91